

# Article XXIII. — AN ANNOTATED LIST OF THE ANTS OF NEW JERSEY.

By WILLIAM MORTON WHEELER.

No State in the Union has been so thoroughly ransacked by collectors of insects as New Jersey. Owing to its geographical position and the diversity of its physical conditions, it has been for years the natural collecting ground for the members of flourishing entomological societies in New York, Brooklyn, Newark, and Philadelphia. And while local collectors, since the time of Rev. G. K. Morris and Mrs. Mary Treat, seem to have given little serious study to the ants, they have nevertheless collected specimens in a more or less desultory manner. Frequently when other more attractive insects are not to be taken, the entomologist, rather than return home empty-handed, will capture a few of the ants which are always to be had in abundance. These specimens accumulate in collections and, when sufficiently numerous and provided with accurate locality labels, eventually come to be of great service in faunistic studies like the one here attempted. I have examined such collections in the possession of Messrs. E. Daecke, Wm. T. Davis, H. L. Viereck, and Prof. John B. Smith, and I wish to express my obligations both to these gentlemen and to Dr. Henry Skinner, through whose kindness I have been able to study specimens in the collections of the Philadelphia Academy of Natural Sciences. All of this material, together with such specimens as I have myself been able to collect on several excursions during the past two years, enables me to record a considerable number of different forms from New Jersey.

This is by no means the first list of New Jersey ants to be published. In his 'Catalogue of Insects found in New Jersey,'<sup>1</sup> Prof. J. B. Smith records 66 species from the State. This list, however, includes the names, apparently derived from incorrectly identified specimens, of a number of European and tropical American ants. When we eliminate these, together with some synonyms and apocryphal names, about 44 legitimate entries remain. For the second edition of this work, entitled 'Insects of New Jersey,'<sup>2</sup> the list of ants was revised and extended by Dr. Wm. H. Ashmead till it comprised

<sup>1</sup> From the Final Report of the State Geologist of New Jersey. Vol. II, 1890.

<sup>2</sup> Twenty-seventh Annual Report of the State Board of Agriculture, 1899. Trenton, N. J., 1900.

93 forms, the same number I have recorded in the following paper. But a critical examination of this list shows that it must have been compiled very largely from the literature and not from actual specimens, for it still contains a goodly number of synonyms cited as different species and several worthless names from authors like Say and Buckley who were incapable of describing an ant so that it could be recognized with certainty by any future entomologist. When Ashmead's list is revised it is seen to contain 68 valid forms, and only 53 that show evidence of having been actually taken in New Jersey.

Although my list is in all probability incomplete, it nevertheless bears witness to the richness of the ant-fauna of New Jersey in particular and of temperate North America in general. This is evident from a comparison with some of the well-known myrmecologies of Europe. Forel<sup>1</sup> cites 66 different forms from Switzerland, a country somewhat more than twice as large as New Jersey and of even greater physical diversity. From Sweden, which has 22 times the area of New Jersey, Adlerz<sup>2</sup> records only 36 different Formicidæ and from the vast territory of European Russia Nasonov<sup>3</sup> enumerates only 79. And this latter list even includes a number of Mediterranean forms like the species of *Myrmecocystus*, *Messor*, *Pheidole*, *Dolichoderus*, etc.

As a rule ants depend so intimately for their welfare on precise physical conditions that colonies which have not been established by their queens in proper soil, moisture, and sunlight grow slowly and, like plants under similarly unfavorable conditions, take on a more or less depauperate appearance. This is indicated by the small size of both colonies and individuals, and is most noticeable in species that have exceeded the limits of their normal geographical range. Within this range a species is usually confined to a particular station, so that the collector soon learns to associate species with very definite environments. Among our eastern ants we may recognize at least six such stations, each occupied by a series of species which are often so constantly associated with one another as to recall the plant societies of botanists. According to these stations, the New Jersey ants may be grouped as follows:

1. The *woodland*, or *silvicolous fauna*, comprising the species that inhabit our moist, shady forests. With the extinction or drainage

<sup>1</sup> Les Fourmis de la Suisse. Zurich, 1874.

<sup>2</sup> Myrmecologiska Studier II Svenska Myror och deras Lefnadsförhållanden. Bihang till K. Svenska Vet.-Akad. Handlingar, Band 11, No. 8, 1886.

<sup>3</sup> Contributions to the Natural History of the Ants (Formicarie). Publications of the Lab. Zool. Mus. Univ. Moscow, Vol. IV, No. 1, 1889, pp. 1-42; i-vi, Tab. i-ix (in Russian).

of these forests or the removal of the undergrowth, this characteristic and in many respects very primitive fauna is rapidly disappearing. It comprises the following forms:

<i>Stigmatomma pallipes</i> ,	<i>Aphænogaster piceum</i> ,
<i>Proceratium silaceum</i> ,	<i>Myrmica punctiventris</i> ,
<i>Proceratium crassicornæ</i> ,	<i>Leptothorax longispinosus</i> ,
<i>Ponera pennsylvanica</i> ,	<i>Leptothorax curvispinosus</i> ,
<i>Myrmecina americana</i> ,	<i>Brachymyrmex depilis</i> ,
<i>Protomognathus americanus</i> ,	<i>Lasius myops</i> ,
<i>Stenamma brevicorne</i> ,	<i>Lasius aphidicola</i> ,
<i>Aphænogaster fulvum</i> ,	<i>Lasius speculiventris</i> .

2. The *glade*, or *nemoriculous* fauna, comprising the ants that prefer open sunny woods, clearings, or the borders of woods. This fauna, a portion of which maintains itself even in the gardens and parks of our cities, includes the following:

<i>Solenopsis molesta</i> ,	<i>Formica subintegra</i> ,
<i>Cremastogaster lineolata</i> ,	<i>Formica integra</i> ,
<i>Cremastogaster lutescens</i> ,	<i>Formica difficilis</i> ,
<i>Cremastogaster cerasi</i> ,	<i>Formica exsectoides</i> ,
<i>Aphænogaster tennesseense</i> ,	<i>Formica schaufussi</i> ,
<i>Aphænogaster lamellidens</i> ,	<i>Formica incerta</i> ,
<i>Aphænogaster aquia</i> ,	<i>Formica nitidiventris</i> ,
<i>Leptothorax schaumii</i> ,	<i>Formica fuscata</i> ,
<i>Leptothorax fortinodis</i> ,	<i>Formica subænescens</i> ,
<i>Dolichoderus plagiatus</i> and its sub-species and varieties,	<i>Polyergus lucidus</i> ,
<i>Tapinoma sessile</i> ,	<i>Camponotus castaneus</i> ,
<i>Prenolepis imparis</i> ,	<i>Camponotus americanus</i> ,
<i>Lasius neoniger</i> ,	<i>Camponotus pennsylvanicus</i> ,
<i>Lasius interjectus</i> ,	<i>Camponotus ferrugineus</i> ,
<i>Lasius claviger</i> ,	<i>Camponotus nearcticus</i> ,
<i>Lasius subglaber</i> ,	<i>Camponotus minutus</i> ,
<i>Formica rubicunda</i> ,	<i>Camponotus subbarbatus</i> .

3. The *field*, or *cæspiticolous* fauna, comprising the ants that prefer to nest in grassy pastures and lawns in situations exposed to the full warmth and light of the sun. To this rather limited fauna belong the following:

<i>Myrmica schencki</i> ,	<i>Lasius latipes</i> ,
<i>Tetramorium cæspitum</i> ,	<i>Lasius murphyi</i> .
<i>Lasius brevicornis</i> ,	

4. The meadow, or pratincolous fauna, comprising the following forms, which inhabit low grassy meadows or bogs:

<i>Sysphincta melina,</i>	<i>Cremastogaster pilosa,</i>
<i>Sysphincta pergandei,</i>	<i>Myrmica brevinodis.</i>

5. The heath, or ericeticulous fauna, includes the ants that inhabit rather poor, sandy, or gravelly soil exposed to the sun and covered with a sparse growth of weeds or grasses. To this fauna belong the following:

<i>Pheidole pilifera,</i>	<i>Myrmica sabuleti,</i>
<i>Pheidole vinelandica,</i>	<i>Prenolepis parvula.</i>

6. The sand, or arenicolous fauna, comprising the following ants, which prefer to nest in pure sand:

<i>Monomorium minimum,</i>	<i>Dolichoderus maria,</i>
<i>Pheidole morrisoni,</i>	<i>Dolichoderus gagates,</i>
<i>Pheidole davis,</i>	<i>Tapinoma pruinosum,</i>
<i>Aphanogaster treat,</i>	<i>Dorymyrmex pyramicus,</i>
<i>Myrmica pinetorum,</i>	<i>Prenolepis testacea,</i>
<i>Pogonomyrmex badius,</i>	<i>Prenolepis arenivaga,</i>
<i>Leptothorax davis,</i>	<i>Formica pallide-fulva.</i>
<i>Trachymyrmex septentrionalis,</i>	

A few of our species, like *Lasius americanus* and *Formica subsericea*, are so adaptable that they occur more or less abundantly in all or nearly all of the above stations. Owing to intergradation of these stations in some places, we, of course, have a corresponding mingling of faunas. Thus certain species, like *Monomorium minimum*, seem to belong indifferently either to the heath or sand fauna. In the deserts of the Southwestern States these two faunas may either mingle or be sharply separated from each other. In the Northeastern and Middle States a similar relation obtains between the glade and field faunas which it is often impossible to separate by a hard and fast line. *Formica schaufussi*, for example, seems to occur indifferently in either station.

#### Family FORMICIDÆ.

##### Subfamily PONERINÆ.

##### *Stigmatomma* Roger.

1. *S. pallipes* Haldeman.—Gloucester (Fox); Westville (Fox); Lakehurst (Wheeler); Palisades near Fort Lee (Wheeler).

This singular and primitive ant is subterranean and occurs only

in rich, rather damp woods, under stones, leaf-mould, or more rarely under or in rotten logs. The colonies are very small, usually comprising less than 20, in extreme cases from 40 to 60 individuals. The males and females appear Aug. 20 to Sept. 17. The larvæ are slender, non-tuberculate, and covered with hair. They are fed by the workers on pieces of insect food, not by regurgitation. The cocoons are elongate, elliptical, dark brown. The ants are very timid and rather slow in their movements. When their nests are disturbed they are at first rather neglectful of their young but eventually return and carry them to a place of safety. For further notes on this ant see my paper: 'The Habits of *Ponera* and *Stigmatomma*' (Biol. Bull., Vol. II, No. 1, Nov., 1900, pp. 43-69, 8 figs.).

#### *Sysphincta* Roger.

2. *S. melina* Roger. — This rare ant probably occurs in New Jersey as it has been taken in Pennsylvania. Rev. P. J. Schmitt, O. S. B., found this and the following species under large stones in damp meadows.

3. *S. pergandei* Roger. — Like the preceding, and for the same reason, this species probably occurs in New Jersey.

#### *Proceratium* Roger.

4. *P. silaceum* Roger. — As this species has been taken in Pennsylvania by P. J. Schmitt and as I have taken it at Cold Spring Harbor, L. I., there can be little doubt that it occurs in New Jersey. The very small colonies live in rotten wood in damp, shady forests. The workers move slowly and have a habit of resting on their sides. The pupæ are enclosed in delicate cocoons.

5. *P. crassicornis* Emery. — There is a single worker of this species from Anglesea, N. J., in the collection of the Philadelphia Academy of Sciences.

#### *Ponera* Latreille.

6. *P. coarctata pennsylvanica* (Buckley) Emery. — Camden (Fox); Gloucester (Fox); Anglesea (Viereck); Glassboro (Viereck); Palisades near Fort Lee (Wheeler); Lakehurst (Wheeler); Halifax (Wheeler).

This form, like *Stigmatomma pallipes*, lives in small colonies under stones and vegetable mould and in rotten wood. It prefers rather open woods where there is shade and a fair amount of moisture. The males and winged females may be found in the small, irregularly

excavated nests from Aug. 20 to Sept. 10. The larvæ have four pairs of glutinous tubercles on the dorsal surface of the third to sixth abdominal segments. Like the larvæ of *Stigmatomma* they are fed by the workers with fragments of insect food. The pupæ are enclosed in short, elliptical, sulphur yellow cocoons which have a black meconial spot at the posterior pole. When the nests are disturbed the ants are careful of the eggs and larvæ, but more neglectful of the cocoons. Ergatoid females are occasionally found. They have ocelli and larger eyes than the normal workers and a thorax intermediate in structure between that of the worker and the winged female. For further notes on the habits of this interesting species see my paper: 'The Habits of *Ponera* and *Stigmatomma*' (Biol. Bull., Vol. II, No. 1, Nov., 1900, pp. 43-69, 8 figs.).

Subfamily MYRMICINÆ.

*Myrmecina* Curtis.

7. *M. graminicola americana* Emery.—Riverton (Viereck); Lakehurst (Wheeler).

In the latter locality a single colony of this subspecies was found nesting in the sand in plesiobiosis with a colony of *Myrmica punctiventris* var. *pinetorum* var. nov. Usually *M. americana* nests in rotten wood or under stones in damp shady woods. It is a rare and local species.

*Tomognathus* Mayr.

(Subgen. *Protomognathus* Wheeler).

8. *T. (P.) americanus* Emery.—This rare species has been found in Pennsylvania and at Bronxville, New York, so that it can hardly be absent from New Jersey. It lives as a parasite in the colonies of *Leptothorax curvispinosus* Mayr. The female is winged and not ergatoid like the only other known species of the genus (*T. sublaevis* Nyl.) of Europe. On this account I have thought it best to create a new subgenus for the American species.

*Monomorium* Mayr.

9. *M. pharaonis* Linn.—There can be little doubt that the statement in Dr. Smith's list that this cosmopolitan house ant occurs "throughout the State commonly," is correct. It lives only in houses, warehouses, ships, etc., and has been carried to the different seaports of the globe from its original home in the warmer regions of

the Old World. It is often confounded with our native *Solenopsis molesta* Say but can always be distinguished by its 3-jointed, instead of 2-jointed antennal club.

10. *M. minutum* Mayr var. *minimum* (Buckley) Emery. — Westville (Viereck); Riverton (Viereck); Lakehurst (Wheeler).

This tiny black ant is common in the pine barrens, where it constructs single or closely clustered craters two to three inches in diameter, often about the roots of the plants in the pure sand. The workers forage in files, visiting plants in search of honey-dew and the secretions of extrafloral nectaries. They also eat dead insects with avidity. The colonies in the pine barrens are quite as populous as those of Southern States, like Florida and Texas, where this ant is very abundant.

#### *Solenopsis* Westwood.

11. *S. molesta* Say.—Boonton (Viereck); Fort Lee (Wheeler).

This tiny species is recorded in Smith's list under the name of *S. debilis* Mayr. It is remarkable on account of its great diversity of habits, which exhibit a high degree of adaptability. It is often common in open, grassy places where it may live either in independent formicaries under stones or very rarely in diminutive crater nests, or as a thief-ant in the walls separating the galleries of the formicaries of our larger ants belonging to the genera *Formica*, *Myrmica*, *Stenamma* (*Aphenogaster*), etc. As a free lance it lives on dead insects but when living in cleptobiosis it devours the well-fed larvæ and pupæ of other ants. Under these conditions it escapes unnoticed by its hosts, either on account of its very small size or neutral nest-odor, and takes care to keep its own nests inaccessible to the species on which it preys. In these respects its habits resemble those of the allied European *S. fugax* and *S. texana* of the Southern States. The blackish males and yellow females, which are very much larger than the yellow workers, make their appearance in late August.

*S. molesta* presents, however, another set of habits on which Prof. Forel has thrown considerable doubt, though, in my opinion, without much justification. Since the settling of the country by man this insect has become a formidable house-ant in certain localities. It was found by Mr. Theo. Pergande in houses in Washington, D. C., and Mr. C. E. Brown has repeatedly taken it in the Milwaukee bakeries. I have myself seen enormous colonies in several residences in Rockford, Illinois, where it lives in the masonry and wood work of kitchens and annoys the house-wife by its assiduous visits to any foods

containing fat. It is said not to eat sugar. These facts show that Forel's assertion that Say must have redescribed *Monomorium pharaonis* as *Myrmica molesta* instead of the species afterwards described by Mayr under the name of *Solenopsis debilis* is without foundation.

Still other aspects of this versatile little ant have been described by Prof. S. A. Forbes. I quote from his Seventh Illinois Report<sup>1</sup>: "It [*Solenopsis molesta*] was first found by us June 1-12, 1883, at Normal, Illinois, abundant in many fields of corn, both new and old, and afterwards, May 14-24, 1886, infesting seed corn in the fields at Champaign. In the corn field these ants were usually collected about the kernels in the earth, and frequently more or less hidden in little cavities in the softened grain. May 19, 1887, they were very abundant in a field of corn in sod in Champaign County, eating out the planted kernels. In autumn the same species has been detected by us indulging a similar appetite but in a way to do no harm. Sept. 11-21, 1893, it was found on and within kernels of corn at the tips of ears, which had evidently been injured previously by crickets and grasshoppers. The solid substance of the grains is not actually eaten by these ants, a fact which I demonstrated by dissection of the ants, but it is simply gnawed away, doubtless for the sake of the sweetish and oily fluids of the softened kernels. If plants start from seed thus injured, they are shorter than others adjacent, and have a stunted weak appearance.

"This species has also been several times noticed by us in September in attendance upon the root-louse of corn, *Aphis maidiradicis*, sharing with two other species of ants the cares and benefits of this association. It occurs more frequently, according to our observations, at this season of the year, with the corn-root lice infesting purslane than with those upon the corn itself."

Prof. Forbes's figure and description leave no doubt that the ant he observed was *S. molesta* (= *debilis* Mayr). He calls attention in a previous report to its eating strawberries. This and its corn-eating habits show its relations to the carnivorous and granivorous "fire ant," *S. geminata*, which I have seen eating strawberries and carrying away their seeds on Mr. Kleber's ranch at Corpus Christi, Texas.

#### *Cremastogaster* Lund.

12. *C. lineolata* Say.—Common throughout the State, according to Smith's list. I have seen fine colonies in such widely different

<sup>1</sup> A Monograph of the Insects Injurious to Indian Corn, 1894.



localities as the Ramapo Mountains near Halifax and the sandy barrens about Lakehurst. In the former locality the ants were nesting under stones, in the latter under the bark of pine logs. There is a vestigial tendency in this ant to construct paper-like partitions in its nest, especially when nesting under stones. The workers have a disagreeable penetrating odor. They ascend trees in files and are much given to attending Aphides and Coccidæ. The males and females are very abundant in the nests at Lakehurst as late as Sept. 24.

13. *C. lineolata* var. *lutescens* Emery.—This variety is recorded from New Jersey by Emery (Beiträge, 1894, p. 282), and by Ashmead in Smith's list. I have seen typical specimens from Tinicum, Pa. (Viereck), which is very near the New Jersey boundary.

14. *C. lineolata* var. *cerasi* Fitch.—Anglesea, Clementon, and Riverton (Viereck); Medford (Phila. Acad.).

15. *C. lineolata pilosa* Pergande.—The types of this subspecies are from the District of Columbia and New Jersey. It is common at Lakehurst, nesting in rotten stumps and logs near or in cranberry bogs. In this locality it exhibits two interesting peculiarities, one of which is as flattering as the other is derogatory to its mental plasticity. Occasionally it constructs from particles of sphagnum moss agglutinated with saliva beautiful little "cow-sheds" over the clustered Coccidæ on the twigs of *Pinus rigida*. These sheds are usually elliptical in shape and about the size of a pecan nut or somewhat larger. They are entered by a little round hole, which is never in such a position as to enable the Coccidæ to escape. More than a dozen of these "cow-sheds" were found on one small pine tree about 6 feet high. Notwithstanding their ability to keep Coccidæ in well-constructed sheds, these ants are killed in great numbers by the pitcher plants (*Sarracenia purpurea*). They creep into the leaves, apparently for the purpose of getting at the water in their hollow bases, but are unable to return over the slanting hairs which point down the throats of the pitchers. In some places hundreds of these ants are found in a decomposing mass in the bottoms of the pitchers and probably constitute a valuable source of food to the plants.

#### *Pheidole* Westwood.

16. *Ph. pilifera* Roger.—Boonton (Viereck); Palisades (Davis); Great Notch (Wheeler); Lakehurst (Wheeler).

The androtypes and gynetypes of this species which, together with workers from Pennsylvania and other States, were described by

Mayr under the name of *Ph. pennsylvanica*, came from New Jersey. It nests in sandy or gravelly soil and usually constructs obscure craters with several openings. More rarely it may be seen nesting under stones. The huge-headed soldiers, which are rarely present in considerable numbers, are very timid and seek the remotest galleries whenever the nests are disturbed. As Morris (Amer. Naturalist, Sept., 1880, pp. 669-670) showed long ago, *Ph. pilifera* is a true harvesting ant, storing the chambers of its nests with seeds of grasses and other herbaceous plants. But like other harvesting species (*Pogonomyrmex* species, *Solenopsis geminata* and several species of *Pheidole* in the Western and Southwestern States) it is also very fond of animal food. I have seen the foraging workers of *pilifera* hurrying to their nests with small insects (Jassids, Aphides, etc.). A marriage flight was witnessed July 27 at Rockford, Ill.

17. *Ph. morrissi* Forel. — The types of this species were collected by Morris at Vineland, but it is common in the pine barrens as far north as Lakehurst. It prefers the pure sand and forms low diffuse and often very untidy moundlets sometimes covering one or two square feet and often about the roots of some plant. These nests are very different from the single compact dome-shaped craters in which Forel found this species in North Carolina and in which I have seen it nesting at Jacksonville, Florida, and Montopolis, Texas. The slender yellow workers are extremely active in their movements, the soldiers rather weak and timid. The species is carnivorous. Forel is clearly justified in separating it from *Ph. dentata* Mayr.

18. *Ph. vinelandica* Forel. — The types of this species, as the name indicates, came from Vineland, N. J. (Mrs. Mary Treat). It is not uncommon in the pine barrens where the soil contains some clay. The nests are diminutive scattered craters, rarely more than 1-1½ inches in diameter. This species occurs also at North Woodbury (Viereck), and even as far north as Bronxville, N. Y., where I have taken it in a single locality.

19. *Ph. davisii* sp. nov.

*Soldier*. — Length 3 mm.

Mandibles bidentate at the tip. Head, excluding the mandibles, hardly longer than broad, subquadrate, with slightly convex sides; occipital border deeply excised; upper surface convex, with the occipital groove extending forward to the middle. Eyes about one third the distance from the anterior to the posterior corner. Frontal carinae short, not half as long as the antennal scape, rapidly subsiding behind. Clypeus short, flattened in front, somewhat convex behind, without a median keel; anterior border rather broadly excised

in the middle. Frontal area subtriangular, about as long as broad, with rounded sides and a median carinula. Tips of antennal scapes reaching just beyond the eyes. Pronotum subhemispherical, about half as broad as the head, with prominent but rounded humeri and without a distinct promesonotal constriction. Mesoepinotal constriction rather deep and broad. Epinotum with two stout spines which are further apart than long, rather blunt at their tips, directed upward and backward and somewhat outward, and each continued anteriorly and posteriorly into a prominent ridge. Epinotal declivity gradually sloping between the spines. Petiole from above somewhat violin-shaped, nearly twice as long as broad. In profile the node is high, with a rather sharp transverse border, long concave anterior, and short abrupt posterior declivity. Postpetiole twice as broad as the petiole and twice as broad as long, with a blunt conule in the middle on either side. Gaster somewhat smaller than the head. Legs with slightly incrassated fusiform femora.

Mandibles shining, with coarse, scattered punctures. Clypeus and frontal area shining; the former irregularly rugulose on the sides. Anterior two thirds of the head sharply longitudinally rugose, posterior third smooth and shining, with a few coarse punctures. Thorax subopaque, punctate-rugose, the rugæ on the pro- and mesonotum somewhat concentric on the sides and sometimes leaving a small smooth area in the middle of the dorsum; mesoepinotal constriction and epinotal declivity shining, the latter with transverse rugæ. Petiole subopaque, densely punctate; postpetiole smooth and shining, with more opaque, punctate sides. Gaster smooth and shining.

Body and appendages clothed with sparse, rather long, suberect, yellowish hairs.

Head dark brown; mandibles and a broad band across the anterior portion of the head, reddish yellow; apical third of mandibles, petiole, postpetiole, and gaster black; thorax dark brown, mesoepinotal constriction, epinotal declivity, legs, and antennæ reddish yellow.

*Worker.* — Length 1.5 — 1.75 mm.

Mandibles multidentate, with the two apical teeth most prominent. Head, excluding the mandibles, a little longer than broad, subquadrate, with slightly convex sides and nearly straight posterior border. Eyes a little in front of the middle of the sides. Clypeus short, convex, with its anterior border excised in the middle. Antennal scapes extending a little beyond the posterior corners of the head. Frontal area very distinct, impressed, rounded behind. Pro- and mesonotum evenly rounded above and on the sides, less convex than in the soldier. Epinotum with the basal and declivous surfaces of equal length, the latter very sloping; spines rather acute, about as long as their distance apart at the base, diverging upward, outward, and backward. Petiole very similar to that of the soldier, but proportionally narrower. Postpetiole a little wider than the petiole, as long as broad, with sides faintly angular in the middle.

Mandibles, head, postpetiole, gaster, and appendages very smooth and shining. Cheeks and front with a few longitudinal rugæ. Mandibles coarsely and sparsely punctate, thorax and petiole opaque, densely and very uniformly punctate.

Hairs on the body and appendages white, suberect, and rather sparse; tapering except on the thorax and pedicel, where they are somewhat enlarged towards their tips.

Mandibles yellow, with dark brown or black teeth; head and gaster black; thorax and pedicel black or very dark brown, with yellowish articulations. Antennæ and legs yellow, the former with the club more or less infuscated, the latter with the middle portions of the femora and tibiæ black.

The types are from Lakehurst. There is also a single soldier from Lucaston (Daecke) in my collection. This ant lives in small colonies in the pure, white sand of the pine barrens and makes small craters somewhat larger than those of *Ph. vinelandica*. It is allied to *Ph. bicarinata* Mayr and *Ph. vinelandica*. The soldier differs from that of *bicarinata* in its smaller size, darker color, shorter head, and more extensive sculpture of the head and thorax. The worker is at once distinguished by the opaque, densely punctate thorax, darker color, and smaller size. The soldier of *davisi* differs from that of *vinelandica* in its much darker color, less deeply emarginate clypeus, shorter head and frontal carinæ; while the differences between the workers of the two species are similar to those between *davisi* and *bicarinata*.

I take pleasure in dedicating this new *Pheidole* to Mr. Wm. T. Davis, the well-known naturalist of Staten Island, who introduced me to the interesting fauna and flora of the pine barrens.

#### *Stenamma* Mayr.

20. *S. brevicorne* Mayr.—I have seen five workers of the large typical form of this rare species from Riverton (Viereck). It nests under stones and dead leaves in rich, shady woods. For further notes on its habits see my paper: 'The North American Ants of the Genus *Stenamma sensu stricto*,' *Psyche*, Aug., 1903, pp. 164-168.

(Subgenus *Aphænogaster* Mayr.)

21. *S. (A.) tennesseense* Mayr.—This species in all probability occurs in New Jersey, since it is known from several localities in Pennsylvania, at least as far east as the Lehigh Water Gap. I have taken it also in Connecticut. It differs from our other species of *Aphænogaster* in having very small and very smooth females with huge epinotal spines. These aberrant females probably establish their colonies in nests of *S. fulvum*, in the same way that *Formica difficilis* var. *consocians* establishes its colonies in nests of *F. schaufussi* var. *incerta* (vide infra). At least *tennesseense* is known to occur only in regions where *fulvum* is unusually abundant, and several mixed colonies of the two species, containing queens of *tennesseense* only, have been recorded.

22. *S. (A.) treatæ* Forel. — The types of this species, which is readily recognized by the remarkable lobe on the base of the antennal scape in the worker and female, were taken by Mrs. Mary Treat at Vineland. I have seen many colonies in the pine barrens about Lakehurst. The nests, which are not readily found, except by following foraging workers, are in the sand in the shade of the oaks and pines. The entrance is sometimes produced upwards in the form of a little chimney and the earth or sand pellets removed by the ants while excavating the galleries are scattered about over a circular area 8 to 10 inches in diameter. The workers are very cowardly.

23. *S. (A.) lamellidens* Mayr. — A few colonies, found at Lakehurst, were nesting like the preceding species in rather shady places. Two isolated females were discovered in the act of establishing their formicaries in little cells about 3 inches below the surface of the sand. In one of these incipient nests there were a few larvæ and pupæ, in the other a few diminutive workers.

24. *S. (A.) fulvum* Roger. — Recorded from Caldwell (Cresson). I have always taken this the typical form of the species in rotten wood in rather dense forests. It is much less common than the following subspecies and variety.

25. *S. (A.) fulvum aquia* (Buckley) Emery. — Anglesea (Viereck); Clementon (Viereck); Westville (Phila. Acad.); Jamesburg (Davis); Halifax (Wheeler).

This form occurs under stones in shady woods, often in the same stations as the following variety.

26. *S. (A.) fulvum aquia* var. *piceum* Emery. — Very common in shady woods along the Palisades; also in the Ramapo Mountains, about Halifax. Careful studies of the habits of this ant have been recently published by Miss Adele M. Fielde in a series of papers.<sup>1</sup>

### *Myrmica Latreille.*

27. *M. punctiventris* Roger. — Camden (Smith's List); Riverton (Viereck); Medford (Phila. Acad.); Fort Lee (Wheeler).

The worker of the typical form of this species is dark colored and has apically deflected epinotal spines which are longer than the epinotal declivity. The sculpture of the head, thorax, and pedicel is very coarse. The species, which is by no means common, nests in small colonies under stones in moist, shady woods. The males and

<sup>1</sup> A Study of an Ant. Proc. Acad. Nat. Sci. Phila., Vol. LIII, 1901, pp. 425-449; Further Study of an Ant. *ibid.*, Vol. LIII, 1901, pp. 521-544; Power of Recognition among Ants, Biol. Bull., Vol. VII, 1904, pp. 227-250, etc.

winged females make their appearance during late August and early September.

28. *M. punctiventris pinetorum* subsp. nov.

The workers and females of this form are smaller, much paler in color and much less heavily sculptured than the corresponding phases of the typical species. The epinotal spines are shorter than the epinotal declivity and not deflected at their tips.

A single colony found nesting in pure sand in the pine barrens at Lakehurst.

29. *M. rubra brevinodis* Emery. — The *M. sulcinodis* Nyl. recorded by Mayr from New Jersey is probably *brevinodis* or its var. *sulcinodoides* Emery, which should occur in the State.

30. *M. rubra scabrinodis* Nyl. var. *sabuleti* Meinert. — New Jersey (Emery); Fort Lee (Wheeler).

This variety of the palaearctic *M. rubra scabrinodis* is reddish in color and in the male phase has a very long antennal scape which is somewhat more than a third the length of the funiculus. It nests in sandy or gravelly sunny places such as open pastures, road-sides, etc.

31. *M. rubra scabrinodis* Nyl. var. *schencki* Emery. — New Jersey (Emery); New Brunswick (J. B. Smith); Lahaway (J. B. Smith); Lakehurst (Wheeler).

This form is cited in Smith's List under the name of the European form, *M. lobicornis*. The male has short, thick antennal scapes which are shorter than those of *sabuleti*, being rarely longer than one fourth of the funiculus.

*Pogonomyrmex* Mayr.

32. *P. badius* Latreille. — This ant, the "Florida harvester," is recorded in Smith's List as occurring at Caldwell (*teste* Cresson). This is certainly very far north but is not impossible as several Floridian insects have been taken in New Jersey.

*P. badius* is abundant in the vicinity of Jacksonville, Fla., where I have made a few observations on its habits. Its nests are flat circular craters, 5-10 inches in diameter, with a central perpendicular or somewhat inclined entrance and usually a lot of chaff about the rim. This chaff is stripped from the stored seeds by the workers. There is no circlet of living grass about the periphery of the craters, which may be single or in groups and resemble those of *P. comanche* in the sandy post-oak woods of Texas. The Florida species is peculiar in having polymorphic workers. The big-headed major workers,

or soldiers seem to be no more vicious than the small and intermediate forms. Smaller nests contain very few or none of the big-headed individuals, which naturally increase in number with the growth of the colony.

**Leptothorax Mayr.**

33. *L. longispinosus* Roger. — This species is recorded from New Jersey by Emery. I have taken it in the woods about Fort Lee. It nests under small stones lying on large boulders, in the clefts of rocks, in stone walls, and more rarely under bark. It seeks its food on the low vegetation in the shade of the trees.

34. *L. curvispinosus* Mayr. — Clementon (Viereck); Riverton (Viereck); Lakehurst (Wheeler and Davis); Fort Lee (Wheeler).

This species usually nests in hollow twigs of the elder in shady woods. Two fine colonies were found at Lakehurst in oak-galls (*Amphibolips ilicifoliae* Bassett and *A. confluentus* Harr.).

35. *L. schaumii* Roger. — There can be little doubt that this species occurs in New Jersey as it is known to occur in Pennsylvania and has been found near New York City. I have seen it nesting in the bark of large elms and willows.

36. *L. fortinodis* Mayr. — A small colony of this species was found at Lakehurst nesting in the bark of a living pitch-pine (*Pinus rigida*).

37. *L. texanus davisii* subsp. nov.

The worker of this form differs from that of the typical *texanus*, all three phases of which I described from Milano, Texas,<sup>1</sup> in the much less rugose surface of the head, thorax, and pedicel. This is especially noticeable on the thoracic dorsum, petiole, and postpetiole, where, instead of the deep reticulate rugosity of the typical form, the surface is finely and evenly reticulate and therefore much more shining. Corresponding differences are observable between the females of the two forms. The female *davisii* has the upper surfaces of the petiole and postpetiole shining though rugose. The epinotal spines are also longer and more robust than in the typical *texanus*.

Described from several workers and a dealated female taken at Lakehurst. Like the Texan form, *davisii* nests in pure white sand, forming slender galleries a few inches in length. It moves about rather slowly on the sunlit surface of the sand in search of small insects.

<sup>1</sup> Proc. Phil. Acad. Nat. Sci., 1903, pp. 245-247.

*Tetramorium* Mayr.

38. *T. caespitum* Linn. — Camden Co. (Daecke). — I have seen this species, the "lawn ant," only at Fort Lee. It is evidently imported from Europe and seems to be making but slow progress over the country. It occurs northward and eastward of New York as far as the Connecticut boundary, westward as far as Philadelphia, and southward as far as Virginia. Emery mentions its occurrence also in Tennessee and Nebraska, but I have never been able to find it in the Middle West.

*Strumigenys* F. Smith.

39. *S. pergandei* Emery. — This and the two following species are known to occur in Pennsylvania, and will doubtless be found also in New Jersey. They are all very rare ants and nest in the ground, often in plesiobiosis with larger species (*Formica*, etc.).

40. *S. pulchella* Emery.

41. *S. clypeata* Roger.

*Atta* Fabricius.

(Subgenus *Trachymyrmex* Forel.)

42. *A. (T.) septentrionalis* McCook (= ? *tardigrada* Buckley). — Vineland (Mrs. M. Treat, McCook); Toms River (Morris); Lakehurst (Wheeler).

This species, called the "northern cutting ant" by McCook, is the only one of the North American *Atti*, or fungus-growing ants, whose range extends into the Northern States. It is abundant in the pine barrens about Lakehurst, nesting in pure white sand. It moves very slowly and is so timid that it retreats into its nest at the slightest alarm. The nest is not easily found except during the spring and autumn when the ants are actively excavating. At such times one may find a circular nest-entrance about three sixteenths of an inch in diameter and an inch or two to one side of it a pile of sand brought out by the workers. The entrance leads into an oblique gallery which widens at intervals into two or three spheroidal chambers varying from 1-2 inches in diameter. Sometimes these chambers form the blind terminations of two or three different galleries branching off from the main or entrance gallery. The rootlets of plants are left spanning the chambers and from these fibrous supports the



fungus gardens are suspended. They consist of a substratum of bits of leaves, buds, green seeds, and caterpillar excrement collected by the ants and woven together by the white hyphæ of a mould-like fungus, which is carefully cultivated by the insects and constitutes their only food. Since the culture of the fungus depends on definite degrees of moisture and temperature the ants are very careful of the ventilation of their nest. During the dry spells of midsummer the entrance is closed with bits of leaves and twigs to prevent the escape of the requisite humidity. At such times it is almost impossible to find the nests. In spring, however, when, after the first warm rains, the ants are clearing and renovating their chambers, and again in the fall after they have raised their brood and are preparing for the winter, the external architecture of the nest is more noticeable. The colonies of *A. septentrionalis* in New Jersey are feebler than those which I have seen near Miami, Florida, and near Austin, Texas. This somewhat depauperate character is evidently the result of unfavorable conditions at the extreme edge of the range of the species, which can hardly extend further north than the pine barrens.

#### Subfamily DOLICHODERINÆ.

##### *Dolichoderus* Lund.

43. *D. mariæ* Forel. — Vineland (Mrs. Mary Treat); Manumuskin (Daecke); Clementon (Viereck); Lakehurst (Davis and Wheeler).

This ant is one of the most beautiful insects of the pine barrens, where it nests in the pure sand in colonies comprising thousands of individuals. The nests are frequently excavated about the roots of grass (*Andropogon scoparius*) or turkey-beard (*Xerophyllum setifolium*). The workers remove nearly every particle of sand from the roots and dig a pot-shaped cavity from 12-18 inches in depth and 3-5 inches in diameter. The spaces between the root-fibers serve as galleries and in them the larvæ and pupæ are kept. The withdrawal of so much sand from the roots of the grass often destroys the vigor of the plant and prevents it from flowering. Bits of dead leaves, pine-needles, etc., are heaped over the surface between the grass blades, sometimes in sufficient quantity to form a flat mound, but quite as often the top of the nest is concave, owing to the withdrawal of the sand and its being only partially replaced by vegetable débris. The nests are most easily located by first finding the workers on the foliage of the oaks and pines, where they attend plant-lice and mealy-

bugs, and thence tracing them as they move homeward in uninterrupted files often over considerable distances (30-50 ft.). It is probable that the number of plant-lice and mealy-bugs within a radius that can be conveniently patrolled by a single colony of *maria* is far from sufficient to supply its thousands of workers with food. Hence the colonies must from time to time move to new localities and establish fresh nests. This is easily accomplished owing to the ease and rapidity with which the sand can be excavated by a populous colony. *D. maria* is a pugnacious ant and when disturbed emits from its anal gland a peculiar volatile, smoky excretion which is unlike that of our other *Dolichoderine* genera (*Tapinoma*, *Dorymyrmex*). The males and winged females are found in the nests during the latter part of August. For additional notes on this and the following *Dolichoderi* see my paper: 'The North American Ants of the Genus *Dolichoderus*,' Bull. Am. Mus. Nat. Hist., Vol. XXI, 1905, pp. 305-319.

44. *D. maria davis* Wheeler. — Jamesburg (Davis).

The worker differs from that of the typical form in having erect hairs on the head and thorax, which are also of a somewhat browner color. Only the base of the first gastric segment is yellow and the lateral spots on the second are barely indicated.

45. *D. taschenbergi* Mayr var. *gagates* Wheeler. — Iona (Daecke); Jamesburg (Davis); Clementon (Viereck); Lakehurst (Davis and Wheeler).

This form is as common in the pine barrens as *D. maria* and has very similar habits.

46. *D. plagiatus* Mayr. — Iona (Daecke); Jamesburg (Davis); Riverton (Viereck); Lakehurst (Wheeler).

Like *D. maria* and *gagates*, this species nests in the ground and attends Aphides on the leaves of trees and bushes. Its colonies are very small.

47. *D. plagiatus* var. *inornatus* Wheeler. — This variety, which occurs at Lakehurst, differs from the typical form in lacking the yellowish spots on the gaster.

48. *D. plagiatus pustulatus* Mayr. — This variety occurs at Lakehurst. It differs from the typical *plagiatus* in having the head and thorax more shining and less deeply foveolate.

49. *D. plagiatus pustulatus* var. *beutenmuelleri* Wheeler. — This variety occurs at Lakehurst. It differs from the typical *pustulatus* in the same way as the variety *inornatus* differs from the typical *plagiatus*, namely in lacking the yellowish spots on the gaster.

*Tapinoma Förster.*

50. *T. sessile* Say.—Camden Co. (Fox); Caldwell (Cresson); Clementon (Viereck); Cape May (Phila. Acad.); Fort Lee, Halifax, Lakehurst (Wheeler).

Probably very common throughout the State. It nests under stones, dead leaves, logs, bark, etc., usually in sunny places. The larvæ and pupæ are salmon colored. The workers emit a peculiar rancid-butter odor, the characteristic "*Tapinoma* odor," also observed in the two following species.

51. *T. pruinatum* Roger. — Atco (Viereck); Halifax (Wheeler); Lakehurst (Wheeler).

The occurrence of this species as far north as New Jersey has been overlooked hitherto. It is readily distinguished from *T. sessile* by its smaller size, paler color, and silvery or frosty appearance. At Lakehurst, it nests in pure, white sand, forming single or clustered craters somewhat like those of *Monomorium minutum*. I have also seen a colony nesting under a stone at Halifax and another near Ramapo in the Ramapo Mountains.

*Dorymyrmex Mayr.*

52. *D. pyramicus* Roger. — South Jersey (Smith's List); Lakehurst (Wheeler).

A few colonies belonging to a dark variety of this southern species, near var. *niger* Pergande, were seen nesting in the white sand at Lakehurst. It is probable that the species is really common in the southern portion of the State as claimed in Smith's List. The nest is a small regular crater 3 or 4 inches in diameter.

## Subfamily CAMPONOTINÆ.

*Brachymyrmex Mayr.*

53. *B. heeri depilis* Emery.—Great Notch (Wheeler); Fort Lee (Wheeler).

This tiny ant is found nesting under stones in shady woods. The workers seem to be subterranean in their habits, rarely or never coming to the surface, at least during the daytime. They resemble the yellow species of *Lasius* in their habit of cultivating root-coccids in their subterranean galleries and chambers. The pupæ are not nude, like those of the following genus, but enclosed in cocoons. The males and relatively large females make their appearance in late August.

*Prenolepis* Mayr.

54. *P. imparis* (Say) Emery. — Caldwell (Cresson); Camden Co. (Fox); Halifax (Wheeler).

This is the largest and most widely distributed of the North American species of the genus. It prefers to nest in shady oak woods in soil containing more or less clay. It is almost never found nesting under stones but forms small circular craters consisting of earthen pellets. The workers visit trees for the purpose of feeding on

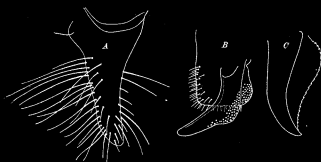


Fig. 1.—A outer, B median, and C inner genital valve of male *Prenolepis imparis* Say.

the excretions of the extrafloral nectaries. I have seen them eagerly licking these organs on the leaves of *Ailanthus glandulosus*. After imbibing these liquids the gaster often becomes so distended that it

is four or five times its normal size and the elegant gait of the insect becomes an awkward waddle. In this replete condition the *P. imparis* worker may be said to represent a temporary stage of the more extraordinary development of the gaster seen in the honey-ants (*Myrmecocystus*). The males and females of *P. imparis* often pass the winter in the parental nest and celebrate their nuptial flight in the spring.

55. *P. imparis* var. *testacea* Emery. — Clementon (Viereck); Medford (Viereck); Lakehurst (Davis and Wheeler).

A pale variety which nests only in sandy regions and on this account is the only form of the species to be found in localities like the pine barrens. It is exceedingly common at Lakehurst but seems to be somewhat nocturnal in its habits. Once only during the daytime have I seen the workers leaving the nest in a file to visit some Aphides on a neighboring oak. They readily assume the replete condition, and owing to their yellowish color resemble the honey-ants even more closely than do the workers of the typical form.

56. *P. parvula* Mayr. — Atco (Viereck); Clementon (Viereck);

Brown's Hill Junction (Daecke); Halifax (Wheeler); Lakehurst (Wheeler).

This tiny species is not uncommon under stones in gravelly and sunny places. At Lakehurst it prefers to nest under the great patches of moss and lichen that spread over the sand in the dry woods. In this species, too, the males and winged females pass the winter in the parental nest and take their nuptial flight in the early spring.

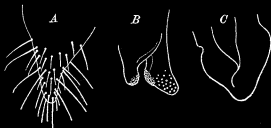


Fig. 2.—A outer, B median, and C inner genital valve of male *Prenolepis parvula* Mayr.

#### 57. *P. arenivaga* sp. nov.

*Worker.* — Length, 2–2.5 mm.

Mandibles with oblique blades, 6–7 toothed, third and fifth tooth from the apex smaller than the others. Clypeus convex, carinate, with the anterior border faintly and sinuately excised in the middle. Head, including the mandibles, distinctly longer than broad, not narrower in front than behind, cheeks rather convex; occipital border very faintly excised. Antennae slender; scape surpassing the posterior corner of the head by at least two fifths of its length. Funicular joints twice as long as broad, except the second to fourth, which are a little longer than broad. Thorax robust, mesoepinotal depression pronounced, its floor somewhat longer than the transverse distance between the two metathoracic stigmata. Petiole small and narrow, cuneate in profile, inclined forward, its ventral surface slightly convex; its upper border blunt in profile, rounded when seen from behind. Gaster and legs of the usual structure.

Surface of body smooth and shining, antennae and legs somewhat more opaque.

Body covered with very minute white pubescence which is dense on the antennae and legs but sparse on the body. Antennal scapes, femora, tibiae, and body with tapering erect or suberect hairs which have dark brown or black bases and white tips. These hairs are very conspicuous on the upper surface of the head, thorax, and gaster.

Pale yellow throughout, mandibular teeth and eyes black.

*Male.* — Length, 1.8–2 mm.

Mandibles well-developed but edentulous. Clypeus and head, except for the ocelli and more prominent eyes, in shape somewhat like that of the worker. Antennae slender; scape extending nearly half its length beyond the posterior corner of the head. Mesonotum broad and convex anteriorly, but depressed just in front of the convex scutellum. Epinotum in profile rather sloping, with a but faintly indicated angle between its longer basal and shorter declivous surfaces. Petiole like that of the worker. Genital appendages all long and slender,

outer pair triangular, nearly three times as long as broad at the base, tapering to a rounded tip; the bifurcated median pair are slender, digitiform, with the papillose surfaces at the tip; the inner pair are simple and triangular,

with tapering rounded tips. Legs long and slender.

Shining; the head and thorax a little more opaque than the gaster as their surfaces are somewhat shagreened. Appendages subopaque.

Pile and pubescence simi-

lar to those of the worker. Hairs on the outer genital appendages rather feeble.

Dark brown, gaster nearly black. Mouth parts, articulations of legs, wing-insertions, antennal funiculi, and genital appendages yellow or pale brown. Wings uniformly grayish hyaline, with very pale veins.

Described from several specimens taken in the pine barrens at Lakehurst, Sept. 25, 1904. This species occurs also in the sandy post-oak woods at Delvalle and Montopolis near Austin, Texas. In all these localities it lives in the pure sand and makes the same kind of nests, namely, flat craters about  $1\frac{1}{2}$  to 2 inches in diameter with a small central entrance. At Lakehurst the ants live in the pure white sand overlying a layer of ochre yellow sand. As they dig down into the latter the craters contrast in color with the surrounding white surface.

Although the worker of *P.*

*avenivaga* resembles that of *P. guatemalensis* in its pale yellow color, the former species is nevertheless clearly distinct as shown by the

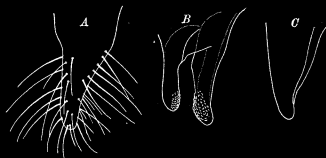


Fig. 3.—A outer, B median, and C inner genital valve of male *Prenolepis arenivaga* sp. nov.

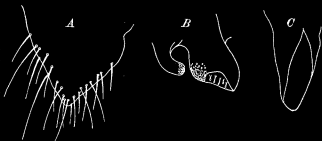


Fig. 4.—A outer, B median, and C inner genital valve of male *Prenolepis guatemalensis* Forel.

genital valves of the male. For the sake of comparison I figure the valves of *guatemalensis* (Fig. 4) and of the three species enumerated from New Jersey (Figs. 1 to 3). The valves of two other North American species (*P. bruesi* Wheeler and *P. melanderi* Wheeler) are given in Psyche (June, 1903, pp. 104 and 107), and Emery (Beiträge, etc., 1893, pl. xxii, Fig. 24) has figured the outer genital valves of *P. fulva* Mayr.

#### *Lasius Fabr.*

58. *L. niger* Linn. var. *americanus* Emery.—Camden, River-ton, and Anglesea (Viereck); Cape May (Phila. Acad.); Jamesburg (Davis); Halifax, Lakehurst, and Fort Lee (Wheeler).

This form passes in much of our entomological literature as *L. alienus*, although Emery has given reasons for regarding it as distinct from the European form. It is not only the commonest of our numerous species of *Lasius* but the most abundant of our ants, and hence of all our insects. It occurs over the whole of North America except the extreme southern and southwestern portions, from timber-line on the highest mountains to the sands of the seashore. Even in circumscribed localities it shows in its nesting sites great adaptability to different physical conditions, from the damp rotten wood of dense forests to the sandy soil of dry, sunny roads. Usually the workers living in the latter stations are much paler in color than the woodland forms and might be regarded as representing a distinct variety. The nests are indifferently under bark, logs, or stones, in rotten wood or in the soil. When in soil they are surmounted by small single or clustered craters. Like all of our other species of the genus, *L. niger* var. *americanus* is much given to cultivating root-coccids and root-aphids in the chambers and galleries of its nests, but, with the exception of the var. *neoniger*, it is the only one of our forms that is not exclusively subterranean in its habits. It may often be seen visiting the foliage of trees and bushes in search of Aphides and small insects. Prof. A. S. Forbes<sup>1</sup> has shown that this insect is of considerable economic importance on account of its noxious habit of cultivating the root-aphids of maize, or Indian corn (*Aphis maidiradicis*). His observations are well worth quoting, as they throw light not only on the habits of this and our other species of *Lasius* but also of other aphicolous ants:

"Seven kinds of ants have been found by us fulfilling the reaction

<sup>1</sup> A Monograph of Insect Injuries to Indian Corn. Part I. Trans. Dep. Agr. Ill., Springfield, 1894.

of host, guardian, and nurse to the corn root aphid; viz., *Formica fusca*, *Formica schaufussi*, *Lasius niger*, *Lasius niger alienus*, *Lasius interjectus*, *Myrmica scabrinodis*, and *Solenopsis debilis*. The occurrence in this relation of all but the third and fourth just mentioned is, however, so rare that they need receive here no more than this passing mention, especially as their services to the aphid are, so far as observed, the same in character and value as those of the much more abundant species."

The following notes are given on the life-history, haunts, actions, and habits of the ant:

"The winged sexual forms, male and female, of this ant begin to appear each year, as early as the latter part of June (the 21st to the 27th), hatching from pupæ which may have formed late in May (27th and 28th, by our notes). The emergence of males and females from the pupæ continues throughout the season, certainly into October and probably to November, but the males perish before the winter. The females, however, having been fertilized and deprived of their wings, begin their separate excavations in fall, or continue with the workers in nests already established. There they hibernate, sometimes, at least, commencing to lay their eggs in fall and living in spring through April and May.

"The nests or burrows of this ant, in which these breeding operations are carried forward, are widely distributed in corn fields and grass lands, — especially in the latter, along the borders of roads and paths, — and also under stones and boards, in and under decaying logs, and in an indefinite variety of situations. In corn fields they are established almost wholly in the hills of corn, and remain here among the old corn roots throughout the season. As this is the commonest and most generally distributed of all our ants in Illinois, an exhaustive list of its places of habitation would have little present interest. It has never been found by us to form large settlements, or making mounds or conspicuous structures of any kind; but simply scattering its little burrows almost indiscriminately, living in small families rather than great colonies or city-like aggregations, and piling up only a small temporary heap of pellets around the mouth of its burrow. When its mines are explored they are found to consist of irregularly radiating and connected tunnels, rarely going to a greater depth than six or eight inches, or extending outward over a horizontal area of more than twelve or fifteen inches. Here and there in their course and at their extremities and at various depths are chamber-like enlargements in which their eggs and young and



the eggs of the corn root aphid are preserved and cared for. Here also considerable collections of the worker ants are usually found, — especially in winter and in times of summer drouth, — and in these chambers the female resides and lays her eggs. . . .

"The fact has already been mentioned in this paper that the sexual egg-laying generation of the corn root aphid — the last to appear in fall — is born in the galleries of the nests or homes of the ants, and that here the sexes pair and the females drop their eggs. As one explores these nests in November, when the root louse eggs are being laid, he is struck with the relative independence of these oviparous adults, which are allowed to wander unattended through the burrows of their hosts as far as a foot or more from a corn root. We have found them, however, still feeding as late as November 5, and laying eggs November 21. These eggs, which are yellow when first deposited, but soon become shining black, and turn green just before hatching, are at first scattered here and there, as it happens, but are finally gathered by the ants for the winter in little heaps and stored in their galleries, or sometimes in chambers made by widening the galleries as if for storage purposes. If a nest is disturbed, the ants will commonly seize the aphid eggs — often several at a grasp — and carry them away. In winter they are taken to the deepest parts of the nest (six or seven inches below the surface in some cases observed) as if for some partial protection against frost; but on bright days in spring they are brought up, sometimes within half an inch or less of the surface, sometimes even scattered about in the sunshine, and carried back again at night—a practice probably to be understood as a means of hastening their hatching. I have repeatedly seen these ants in confinement with a little mass of aphid eggs, turn the eggs about one by one with their mandibles, licking each carefully at the same time as if to clean the surface. These anxious cares are of course explained by the use the ants make of the root lice, whose excreted fluids they lap up greedily as soon as the young lice begin to feed. They are not, however, wholly dependent on this food supply, at least in early spring, as I have seen them kill and drag away at that season soft-bodied insect larvæ, doubtless to suck their juices out as food. . . .

"That the young of the first generation are helped by the ants to a favorable position on the roots of the plants they infest is quite beyond question. It is shown (1) by the fact that in many cases the aphid could not get access to such roots unless these had been previously laid bare by the tunneling of the ants, and (2) by the

behavior of ants with mines already constructed, when the root aphid is offered to them. We have repeatedly performed the experiment of starting colonies of ants on hills of corn in the insectary and exposing root lice from the field to their attentions, and in every such instance, if the colony was well established, the helpless insects have been seized by the ants, often almost instantly, and conveyed underground, where we would later find them feeding and breeding on the roots of the corn. In many cases in the field, we have found the young root aphid on sprouting weeds (especially pigeon-grass), which have been sought out by the ants before the leaves had shown above the ground; and, similarly, when the field is planted to corn, these ardent explorers will frequently discover the sprouting kernel in the earth, and mine along the starting stem and place the plant lice upon it. . . .

"I need hardly say that the relations above described between the corn root aphid and these ants continue without cessation throughout the year, the succeeding generations being quite as useful to the ants as those whose history I have thought it worth while to follow in detail. In order to determine more precisely the value of the services performed by their guardians, I arranged in several years a series of experiments designed to show to what extent the plant lice could help themselves if left unattended. Owing to the waywardness of the ants, which in most cases refused to content themselves in confinement, but one of these experiments came to a successful issue. April 13, 1889, corn root aphid eggs were placed in the earth among smart-weed roots to test the ability of the young lice hatching to find the roots for themselves. A check experiment was started at the same time with eggs placed in artificial cavities beside smart-weed roots. April 25 no insects could be found on the plants of the first experiment, while the cavities made in the second experiment contained young lice upon the roots in fine condition."

59. *L. niger* var. *neoniger* Emery.—This variety is characterized by having erect hairs on the legs and antennal scapes. It is much less abundant than the preceding and seems to have a northern or subboreal distribution. A few specimens from Anglesea (Viereck) and Hewitt (Davis) belong to this variety.

60. *L. brevicornis* Emery.—I have taken this species at Fort Lee, Halifax, Lakehurst, and near the Great Notch. It nests under stones, on hill slopes and in pastures, in rather small colonies, cultivates root-aphids, and, so far as I have been able to observe, is strictly subterranean like all of the remaining species of *Lasius* recorded in this list. The workers have a faintly pungent odor.

61. *L. myops* Forst.—Great Notch (Wheeler); Halifax (Wheeler).

This is the American representative of the European *L. flavus*, under which name it is sometimes recorded in the literature. The bodies of the workers have a milky white appearance. According to my observations this ant always occupies a definite station, preferring to nest under stones, or leaf-mould in damp, shady woods. The colonies are rather small. The males and winged females may be found in the nests during the first week of August.

62. *L. umbratus mixtus* Nyl. var. *aphidicola* Walsh.—Caldwell (Emery); Woodbury (Viereck); Fort Lee (Wheeler); Great Notch (Wheeler).

This ant forms much larger colonies than the preceding species. It prefers damp, shady woods and in the Eastern States nests under large stones and in and about old logs and stumps. In the Middle West (Wisconsin and Illinois) it often builds considerable mounds of earth (1-5 ft. in diameter and  $\frac{1}{2}$ -1 ft. high) around or over decayed stumps. These mounds are perforated with numerous openings and shot through with living grass blades. During winter and early spring, but especially during the latter season, the nests teem with snow-white Aphides and coccids which are cared for by the ants. The males and winged females appear Aug. 2-11.

63. *L. umbratus mixtus* var. *affinis* Schenck.—This European variety is recorded by Mayr from New Jersey. I have not yet been able to recognize it among any of my specimens collected in the United States.

64. *L. umbratus minutus* Emery.—This subspecies was described by Emery from specimens collected in New Jersey and Maine. In my collection there are three workers marked New Jersey, received from Mr. Pergande.

65. *L. speculiventris* Emery.—The types of this species are from Caldwell. I have taken it at Fort Lee and Great Notch. The colonies are very large, like those of *L. aphidicola*, and are found under stones or rotten logs in rich, shady woods. A populous colony found in the early spring at Fort Lee in a pine stump contained thousands of snow-white Aphides of all ages. The females of this species are unknown.

(Subgenus *Acanthomyops* Mayr.)

66. *L. (A.) interjectus* Mayr.—Caldwell (Cresson); Lakehurst (Wheeler).

The yellow *Lasii* of the subgenus *Acanthomyops* besides having only

3- instead of 6-jointed maxillary palpi in the worker and female phases, have a peculiar and rather agreeable odor like oil of citronella, quite unlike the odor of the typical *Lasius*. They all form large colonies and lead a subterranean, aphidicolous existence. *L. interjectus* is the largest species of the genus. It is found nesting in old logs and stumps in open woods and occasionally makes rough mounds or merely excavates its galleries under large stones. The mound nests, like those of *L. aphidicola*, often attain considerable dimensions in Wisconsin and Illinois where *interjectus* seems to be more abundant than in the Eastern States.

67. *L. (A.) claviger* Roger.—Caldwell (Cresson); Camden Co. (Smith); Merchantville (Daecke); Riverton (Viereck); Fort Lee, Lakehurst, and Halifax (Wheeler).

This is the commonest of our species of *Acanthomyops*. It nests under stones along the edges of woods where there is plenty of warmth and moisture. The males and winged females may be found in the nest as early as Aug. 25, though the nuptial flight may not occur till a month later.

68. *L. (A.) claviger subglaber* Emery.—As this subspecies is found near New York City I believe there can be no doubt of its occurrence on the western bank of the Hudson. It may be distinguished from the typical *claviger* in all three phases by its somewhat smaller size. The hairs on the gaster and thorax of the female are shorter and less abundant than in the type.

69. *L. (A.) latipes* Walsh.—Camden (Smith); Weymouth (Daecke); Fort Lee (Wheeler).

This species is rather common in grassy fields under large stones. Mr. J. F. McClendon and myself have shown<sup>1</sup> that some colonies have two kinds of females. One of these (the  $\beta$ -female) is very hairy, has much flattened femora and tibiae, and the hind tarsus is shorter than the hind tibia. The other ( $\alpha$ -female) is intermediate in structure between the  $\beta$ -female and the female of *L. claviger*.

70. *L. (A.) murphyi* Forel.—There can be little doubt that this interesting species, hitherto known only from North Carolina, occurs in New Jersey. In the Angus collection of the American Museum of Natural History there are a number of specimens of all three phases collected at West Farms, which is now a part of Greater New York, and I have taken females, that had just descended from their nuptial flights, at Cold Spring Harbor, Long Island, and at Mount Kisco, New York.

<sup>1</sup> Dimorphic Queens in an American Ant (*Lasius latipes* Walsh). Biol. Bull., Vol. iv, pp. 149-163, 3 figs.

*Formica* Linn.

71. *F. sanguinea rubicunda* Emery.—Delaware Water Gap (Viereck); Woodbury (Phila. Acad.).

This subspecies of the holarctic blood-red slave-maker, or sanguinary ant, is less common than the next. Its nests are usually under stones in grassy places along the edges of woods. It obtains slaves, or auxiliary workers by kidnapping the young of *F. subsericea*.

72. *F. sanguinea rubicunda* var. *subintegra* Emery.—This variety is recorded from New Jersey by Emery. I have seen a single incipient colony of it at Lakehurst, but it is probably more abundant in the less sandy portions of the State. The slaves belong to *F. subsericea* as a rule, but the colony at Lakehurst contained instead workers of *F. schaufussi*. This is probably the normal auxiliary form in this region owing to a scarcity of *subsericea* colonies. In the vicinity of New York *subintegra* is the only form of *sanguinea* I have been able to find.

73. *F. rufa obscuriventris* Mayr.—This subspecies is mentioned by Mayr as occurring in New Jersey. I have not seen specimens of it from this State. It is probably a western ant.

74. *F. rufa integra* Nylander.—Caldwell (Cresson); Clementon (Viereck); Sea Isle City (Viereck); Jamesburg (Davis); Lakehurst (Wheeler).

Our largest and most conspicuous form of *rufa*, nesting in great colonies which often comprise several nests. These are in piles of large stones or old logs and stumps. The ants stuff all the crannies of their abodes with bits of dead grass, leaves, etc. Like most other species of *Formica*, *F. integra* is much given to attending Aphides. It is most abundant in hilly regions where it prefers sunny glades or clearings in the forests.

75. *F. difficilis* Emery.—Some of the types of this species were received by Emery from New Jersey. I have taken a few workers near Halifax in the Ramapo Mountains.

This interesting species has very small yellow females which are in all probability temporary parasites in the nests of *F. schaufussi* var. *incerta*, as I have shown to be the case in *F. difficilis* var. *consocians* of Connecticut. The young fertilized female of this variety seeks adoption in some depauperate and probably queenless colony of *incerta* and permits her hosts to bring up her young. Later the *incerta* workers die off, leaving the *difficilis* as a pure and independent colony which soon grows rapidly in size and shows no evidence of its

parasitic origin. The nesting habits of *difficilis* resemble those of *F. integra* on a small scale, especially as a colony is confined to a single nest. See my paper: 'A New Type of Social Parasitism Among Ants,' Bull. Am. Mus. Nat. Hist., Vol. XX, 1904, pp. 347-375.

76. *F. exsectoides* Forel. — Newfoundland (Davis); Palisades (Beutenmueller); Alpine (Am. Mus. Coll.); Ramapo Mountains near Halifax (Wheeler).

This "mound-building ant of the Alleghanies," as McCook has named it, is found nesting in open glades or clearings in the more hilly portions of the State. The mounds which it constructs of earth and vegetable débris are regularly dome-shaped and usually vary from 3-4 ft. in diameter at the base and 1-2 ft. in height. They are exposed to the sun, though often covered with living grass except at the summit. The entrances are very numerous and mostly confined to a broad girdle around the base. A single colony often extends over several mounds. The workers, which are easily distinguished from those of all our other species of *Formica* by the excised posterior border of the head, are very pugnacious. Like the European *F. exsecta* they have a habit of sawing off the heads of other ants.

77. *F. pallide-fulva* Latreille. — Of this typical form of the species I have seen a single worker from Cape May (Coll. Phila. Acad.). This is probably very near the northernmost range of the form.

78. *F. pallide-fulva schaufussi* Mayr. — Caldwell (Cresson); Camden Co. (J. B. Smith); Da Costa (Fox and Daecke); Lucaston (Daecke); Clementon (Viereck); Alpine (Am. Mus. Coll.), Fort Lee, Halifax, and Lakehurst (Wheeler).

This is one of our commonest species of *Formica*. It forms rather small colonies and nests under stones or in small obscure mound-nests in sunny and grassy fields. In the barrens about Lakehurst, where there are no stones, it nests in the dry pine logs or in the pure sand. It is timid and runs very rapidly. Its food seems to consist very largely of the excrement of Aphides and the carcasses of insects.

79. *F. pallide-fulva schaufussi* var. *incerta* Emery. — Recorded by Emery from New Jersey. This variety is common in the same localities as the typical *schaufussi* from which it differs merely in somewhat darker coloration and in having fewer hairs on the chin and border of the petiole.

80. *F. pallide-fulva nitidiventris* Emery. — Recorded by Emery from New Jersey. The workers are smaller than those of the two

preceding forms, dark colored, without hairs on the chin and petiolar border, and with a more shining and less pubescent gaster. The habits are similar to those of other forms of the species.

81. *F. pallide-fulva nitidiventris* var. *fuscata* Emery. — Near Halifax I have taken several workers evidently belonging to this variety, which is characterized by its dark color and rather opaque gaster. It occurs in woods and seems to be less fond of the open, sunny country than the preceding forms of *pallide-fulva*.

82. *F. fusca* Linn. var. *subsericea* Say. — Caldwell (Cresson); New Brunswick (Smith); Jamesburg (Davis); Fort Lee, Great Notch, and Lakehurst (Wheeler).

Next to *Lasius niger* var. *americanus* this is the commonest of our ants in particular and of our insects in general. Like that variety it ranges from timber-line in the Rocky Mountains to the sand of the seashore and from British America to the latitude of North Carolina. It prefers sunny, grassy places and either constructs dome-shaped mounds which are larger and more definite in outline in the Middle States, or excavates its galleries under stones, boards, the bark of stumps, etc. Except when living in large colonies it is a very cowardly species. Like the other members of the genus *Formica* it attends Aphids but is equally fond of feeding on the bodies of dead insects.

83. *F. fusca* var. *subaenescens* Emery. — Emery mentions a New Jersey specimen intermediate between *subsericea* and the true *subaenescens*. There can be little doubt that the pure form of the latter variety occurs in the hilly portions of the State. It is a woodland form, preferring damper soil and more shade than the var. *subsericea*.

84. *F. fusca subpolita* Mayr var. *neogagates* Emery. — Very probably occurs in the hilly portions of the State.

### *Polyergus Latreille.*

85. *P. rufescens lucidus* Mayr. — Camden Co. (Smith's List); Clementon (Fox); Vineland (Mrs. Mary Treat).

This rare and beautiful species, the "shining slave-maker" of McCook, or "shining amazon" as it may be called, uses the workers of *Formica schaufussi* as slaves, or auxiliaries. These are bred from pupæ kidnapped from their maternal nests by the war-like *lucidus* workers. The latter are quite unable to feed themselves, excavate their nests, or care for their own brood, but have to depend for these important activities on the *schaufussi* workers. Hence the *lucidus* are quite unable to live an independent life and may be regarded as

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permanently parasitic on fragments of *schaufussi* colonies which they bring together with great skill. The sexual forms make their appearance during August.

**Camponotus Mayr.**

86. *C. castaneus* Latreille. — Caldwell (Cresson); Sea Isle City (Viereck); Fort Lee (Beutenmueller); Great Notch (Wheeler).

This species nests in the ground, under stones or logs, or in obscure mound-nests, like the typical species of the *Camponotus maculatus* group. It is common neither in New Jersey nor New York State. The latter probably represents the northernmost range of the typical form of the species.

87. *C. castaneus americanus* Mayr. — Manumuskín, Iona, and Da Costa (Daecke); Jamesburg and Paterson (Davis); Halifax and Lakehurst (Wheeler).

Similar in habits to the typical form but apparently more widely distributed and ranging as far north as Massachusetts. The colonies I have seen have all been of small size. The young larvæ are salmon-colored, like those of *Tapinoma sessile*.

88. *C. herculeanus pennsylvanicus* De Geer. — Caldwell (Cresson); Riverton (Viereck); Medford (Phila. Acad.); Westville (Phila. Acad.); North Woodbury (Daecke); Newfoundland (Davis); Halifax (Wheeler); Fort Lee (Wheeler).

This is the common, entirely black form of the "carpenter ant." It nests usually in shady woods in old logs and stumps. Thence it migrates into old farmhouses and suburban residences and becomes a pest both by riddling the woodwork with its large anastomosing galleries and by visiting the pantries and kitchens for sweets.

89. *C. herculeanus pennsylvanicus* var. *ferrugineus* Fabricius. — Delair (Daecke); Camden (Viereck); Boonton (Viereck); Westville (Phila. Acad.); Fort Lee (Coll. Am. Mus.).

A beautiful color variety of *pennsylvanicus* confined, apparently, to the States east of the Mississippi River. Its habits are very similar to those of the typical form, but it seems to be much less abundant.

90. *C. herculeanus ligniperdus* Latreille var. *pictus* Forel. — Although I have seen no specimens of this variety from New Jersey, there can be little doubt that it occurs in the State, as it has been found in Pennsylvania, New York State, and Connecticut.

91. *C. marginatus* Latr. var. *nearcticus* Emery. — Boonton (Viereck); Lakehurst (Davis and Wheeler).



This, the largest and darkest form among the numerous American varieties of this ant, appears to have definite associations with pine trees. It is common at Lakehurst, nesting in the twigs and cones of *Pinus rigida*.

92. *C. marginatus* var. *minutus* Emery. — Great Notch (Viereck).

I have taken it at Halifax in the Ramapo Mountains and at Lakehurst, nesting in dead twigs of oaks and attending Aphides on the leaves.

93. *C. marginatus subbarbatus* Emery. — Westville (Schmitt); Riverton (Daecke).

In the collection of the American Museum there are specimens of all four phases of this subspecies from each of these localities. I have also taken colonies of it near Bronxville, New York, in the hollow stems of elder bushes.